Maine Agricultural Experiment Station

BULLETIN No. 106 SEPTEMBER, 1904.

SOY BEANS.
FEEDING EXPERIMENTS.
ALFALFA.

This Bulletin contains a discussion of the results of experiments with the soy bean in Maine; feeding experiments with cows where soy bean silage is compared with corn silage, and in which Union Grains (Biles Ready Rations) is compared with oil meal and bran; and notes upon experiments with alfalfa.

Requests for bulletins should be addressed to the
AGRICULTURAL EXPERIMENT STATION,
Orono, Maine.

MAINE
AGRICULTURAL EXPERIMENT STATION,
ORONO, MAINE.

THE STATION COUNCIL.

President George E. Fellows	*President*
Director Charles D. Woods	*Secretary*
John A. Roberts, Norway	*Committee of Board of Trustees*
Charles L. Jones, Corinna	*Committee of Board of Trustees*
Albert J. Durgin, Orono	*Committee of Board of Trustees*
Augustus W. Gilman, Foxcroft	*Commissioner of Agriculture*
Eugene H. Libby, Auburn	*State Grange*
Charles S. Pope, Manchester	*State Pomological Society*
Rutillus Alden, Winthrop	*State Dairymen's Association*
James M. Bartlett	*Members of the Station Staff*
Lucius H. Merrill	*Members of the Station Staff*
Fremont L. Russell	*Members of the Station Staff*
Welton M. Munson	*Members of the Station Staff*
Gilbert M. Gowell	*Members of the Station Staff*

THE STATION STAFF.

The President of the University.

Charles D. Woods	*Director*
James M. Bartlett	*Chemist*
Lucius H. Merrill	*Chemist*
Fremont L. Russell	*Veterinarian*
Welton M. Munson	*Horticulturist*
Gilbert M. Gowell	*Stock Breeding and Poultry*
Edith M. Patch	*Entomologist*
Herman H. Hanson	*Assistant Chemist*
Sanford C. Dinsmore	*Assistant Chemist*

SOY BEANS IN MAINE.

CHAS. D. WOODS and J. M. BARTLETT.

The soy bean was introduced into the United States several years ago from Japan, where it is grown for human food. In this country it has chiefly been grown as a forage crop, and as it thrives best in a moderately warm climate is better known in the southern and middle than in the northern states. Some of the earlier varieties, however, will mature seed in New England. At the Massachusetts and Storrs (Conn.) Experiment Stations a few varieties have been grown quite successfully for soiling crops, for silage by itself or mixed with corn, and for the seeds. Farmers' bulletin No. 58 of the United States Department of Agriculture summarizes the present status of the soy bean as a forage crop. Because of numerous inquiries, the Maine station has experimented somewhat with this crop. The results of these experiments are here reported and there is also included such deductions and citations from Farmers' Bulletin 58 and the publications of the Massachusetts and Storrs stations as seem adapted to Maine climate and conditions.

THE PLANT.

"The soy bean is an erect, annual plant, with branching, hairy stem, trifoliate, more or less hairy leaves, rather inconspicuous pale lilac or violet colored flowers, and broad, two to five-seeded pods, covered like the stem, with stiff, reddish hairs. The seeds vary in color from whitish and yellowish to green, brown and black; and in shape from spherical to elliptical and more or less compressed." *

The seeds are self pollinated and on this account are sure to produce seeds wherever the plants reach maturity.

* Farmers' Bulletin 58, U. S. Dept. of Agr.

VARIETIES.

There are numerous quite distinct varieties of the soy bean, only the earliest of which can be grown in Maine. The early white soy bean is the best variety for seed with us. It is not a good variety, however, for soiling or silage on account of its small size, while its tendency to drop its leaves early unfits it for hay. Plants of this variety matured seed at Orono in 1904. The medium early green is one of the best for Maine as it yields heavily and retains its leaves well. This last is an important feature if it is planned to make hay from the crop. The medium early black is the favorite in the central states.

In 1903 and 1904 the Station grew several varieties of soy beans from seed furnished by the United States Department of Agriculture. The early white soy bean matured and the medium early green and black varieties formed pods. The Henderson Early, (a medium early green), purchased from Peter Henderson Company, New York, was as satisfactory as any grown, both in earliness and yield.

CONDITIONS OF GROWTH.

"It is believed in Japan that in northern climates, soils of a rather strong character are best adapted to the soy bean. It is usually sown about the end of May, and when used for hay is cut early in August. In both Europe and America it has been found to thrive best on soils of medium texture that are well supplied with potash, phosphoric acid, and lime. It succeeds very well, however, on comparatively light soils, often giving an abundant crop on soils too poor to grow clover." *

The soy bean requires about the same temperature as corn. Professor Brooks says that the earlier sorts will mature in Massachusetts with as much certainty as will the earlier varieties of corn.

As a general thing, the soy bean is not so easily injured by frost as the common field or garden varieties of beans, and hence it can be planted earlier in the spring and can also be left in the field later in the autumn.

---

* Farmers' Bulletin 58, U. S. Dept. of Agr.

FERTILIZING AND CULTURE.

Like all leguminous plants, the soy bean, through the aid of root tubercle organisms, acquires atmospheric nitrogen. When the soy bean was first introduced into America it did not form root tubercles. In order to insure the growth of the root tubercles it is necessary to use seed that has been inoculated, or to inoculate the soil with the proper organism. This last is readily done by applying broadcast a small amount of soil taken from a field where soy beans developing root tubercles have been grown. At this Station no tubercles formed on plants grown in soil that had not been inoculated, but they grew abundantly where soil from infested soy bean was applied at the rate of a few barrels to the acre. According to our experience the beans will grow as well without the root tubercles as with, provided they are liberally fertilized. Their economical growth depends upon the presence of the root tubercles, as in this way they can be grown with little or no nitrogen in the fertilizer. If they are to be grown on soil containing no root tubercle organisms, they require a fairly liberal application of a complete fertilizer. If grown in good soil where root tubercles may be expected to develop, only phosphoric acid and potash need be supplied in the fertilizer. The soil should be prepared as for ordinary beans. It should be made fine, free from clods and lumps, and smooth. A good seed bed is essential to a good growth.

In this climate the soy bean should be planted a little earlier than ordinary beans, but not until the ground has warmed up considerably. The first season we planted in drills 3 feet apart. This was too far apart for the best yield. Nearly double the yield per acre is obtained when the drills are 16 inches apart. In the case of the wide drills it was necessary to cultivate three times with the horse cultivator. With the drills 16 inches apart they were cultivated once with a hand wheel hoe. On fairly clean land good success may be had with broadcasting or still better by the use of the grain drill. If planted in rows, the seed should be sown with a hand seed drill similar to that used for beets or turnips. It will require about 3 pecks of seed per acre of the medium green soy bean when seeded in drills 16 inches apart. If the seed is broadcast, a bushel will be none too much for an acre. It will probably not be wise to attempt to grow soy beans in Maine for the seed, but if this is done, the drills

should be at least 20 inches apart and the soil should be kept stirred and clean, as in the case of ordinary field beans. If wanted for silage, the beans can be grown alone or planted with corn. The latter method is quite strongly recommended, the seeds being mixed and put in the planter in the proportion of 10 quarts of corn to 7 of beans. The forage from this mixture can be fed green or cut for the silo.

HARVESTING.

From analyses made at the South Carolina Experiment Station it appears that the dry matter carries relatively about the same percentages of protein and fat when the pods are just forming as they do when the pods are well developed. The stalk carries a large amount of crude fiber, and on this account the leaves are the most important part of the green plant for feeding. The yield will be somewhat greater near maturity but when digestibility and palatability are considered, cutting as soon as the pods form is probably better. From our experiments, plants will be ready to cut with corn for silage if the seed is planted about June 10.

If the crop is to be used for soiling, cutting can begin when the plants are in early bloom and can be kept up in this climate until frost. The soy bean is a coarse growing plant and cures slowly, and on this account it is doubtful if it should ever be grown in Maine to be cured as hay. Cock curing is the most practical method, but will be likely to prove unsatisfactory. For the silo the harvesting can be delayed as long as it is prudent to allow corn to stand in the field. A grain reaper and binder can be used to advantage in harvesting this crop for the silo. If in drills 16 inches apart, 3 or 4 rows can be cut at once. A mowing machine can be used to cut the crop, but it will not handle as well for the silage cutter as when in bundles.

In harvesting a crop for seed, it can be cut before the pods are mature. If the pods become too ripe (in this climate there is little danger of this, however,) before harvesting, they are liable to burst and shell and thus part of the seed be lost. In harvesting for seed the crop can be pulled by hand, or cut by hand or machine. It will be quickest cured if put in piles that are relatively high and narrow. Threshing can be by hand or machine.

YIELD.

The yield of green fodder that can be had in Maine will probably vary from 5 to 10 tons per acre. In the large plots grown by this Station in 1903 the largest yield was only a little over 5 tons to the acre. But the rows were twice too far apart, having been planted in drills 3 feet apart. If they had been planted at the same distance as the small plots in 1904 (16 inches) there is no reason for thinking the yield would not have been nearly or quite doubled, for at no time did the plants come near filling the space between the rows. On good land, with fair cultivation and average season, a yield of 8 tons of green fodder could doubtless be counted upon. Cured into hay this would give a yield of about 2½ tons per acre.

NUTRIENTS IN SOY BEAN AND THEIR DIGESTIBILITY.

In the Farmers' Bulletin previously cited, tables arranged with great care showing the chemical composition of the various parts of the soy bean and their digestibility are given. These tables are quoted in the tables on pages 118 and 119 and to them are added the results of analyses and digestion experiments made at this Station with soy bean and corn.

The composition of the soy bean as compared with other legumes stands high. The fodder closely resembles clover in composition and soy bean silage, in both composition and digestibility, is the equal of clover silage. It is doubtful if any more digestible nutrients can be grown from an acre with soy beans than with clover. But in some localities they are a surer crop and need only a single season for their growth. Soy beans would be more naturally compared in this State with corn, for if grown at all they seem best adapted for silage. The chief difference between corn and soy beans is found in the high protein content of the latter. Like other beans it has the power of taking its nitrogen to form protein from the air, and since it is richer in protein than corn, it may be justly considered a desirable addition to the list of forage plants. As the price of feeds rich in protein is advancing it seems very desirable that as many legumes (plants rich in protein) that can gather their own nitrogen from the air be grown as possible.

CHEMICAL COMPOSITION OF SOY BEAN AND CORN FORAGE AND SILAGE.

Forage.	Number of analyses.	Fresh or air-dry substance.						Water-free substance.				
		Water.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.
Early bloom to seed[1]	13	76.5	2.3	3.6	6.5	10.1	1.0	10.0	15.3	27.6	43.0	4.1
Whole plant, pod just forming[8]	1	73.2	2.0	3.0	4.9	15.9	0.9	7.7	11.0	18.5	59.4	3.4
Corn fodder[8]	13	78.9	1.3	2.3	4.2	12.7	0.6	6.1	10.8	19.8	60.3	2.9
Soy bean hay (Jap.)	1	16.0	5.9	16.9	35.9	23.1	2.2	7.0	20.1	42.7	27.5	2.6
Soy bean hay (Mass.)[2]	4	12.1	7.3	14.2	21.1	41.2	4.1	....	16.2	24.0	46.8	4.7
Soy bean straw (Mass.)[2]	3	11.4	6.4	4.9	37.6	37.8	1.9	....	5.5	42.4	42.7	2.2
Soy bean straw, hulls and vines after threshing[3]	1	5.7	3.9	4.0	49.5	36.0	0.8	5.3	4.25	52.5	38.2	0.85
Soy bean seed[4]	8	10.8	4.7	34.0	4.8	28.8	16.9	5.3	38.1	5.4	32.2	18.9
Soy bean meal[5]	2	10.4	5.1	36.0	2.6	27.0	18.9	5.7	40.2	2.9	30.2	21.0
Soy bean silage[6]	1	74.2	2.8	4.1	9.7	7.0	2.2	11.0	15.7	37.6	27.0	8.7
Corn and soy bean silage[7]	4	76.0	2.4	2.5	7.2	11.1	0.8	....	10.4	30.0	46.3	3.3
Corn and soy bean silage[8]	1	79.8	1.2	2.1	5.1	11.1	0.7	5.8	10.5	25.2	55.3	3.2
Mature corn silage	1	79.6	1.0	2.1	4.7	11.8	0.8	4.8	10.2	23.1	57.9	4.0
Immature corn silage	4	79.7	1.0	1.5	5.1	11.8	0.8	4.9	7.4	25.7	59.0	3.0
Millet and soy bean silage[7]	9	79.0	2.8	2.8	7.2	7.2	1.0	....	13.3	34.3	34.3	4.8

[1] Ninth An. Rep. Storrs Exp. Sta., pp. 281, 285 (1896).
[2] Eighth An. Rep. Mass. Hatch. Sta., p. 87 (1896).
[3] Second An. Rep. S. C. Exp. Sta., p. 179 (1890).
[4] Bull. 15 U. S. Dept. Agric., Office Exp. Stations, p. 390 (1893).
[5] Eighth An. Rep. Storrs Exp. Sta., pp. 183, 186 (1895).
[6] Bull. Tenn. Exp. Sta., Vol. IX, No. 3, p. 106 (1896).
[7] Ninth An. Rep. Mass. Hatch. Sta., p. 140 (1897).
[8] Maine Station, unpublished results.

SOY BEAN SILAGE.

The soy bean plants dried do not make desirable forage as the cured stalks are rather coarse and hard, and are therefore best fed green or made into silage. Like most leguminous plants, soy beans do not keep as well in the silo alone as when mixed with corn. Consequently, in the trials made at the Maine Station, the beans were cut and put into the silo with corn. The proportion in this case, for convenience, was about fourteen of corn to nine of beans. The silage kept perfectly and when fed out was nearly as green as when it went into the silo. The

animals ate it with great relish and the sheep preferred it to clear corn silage. The composition of the fresh beans and the silage are given in the table on the opposite page.

Two experiments were made at this Station, one with sheep and one with steers, to ascertain the digestibility of the silage described in the preceding paragraph. The detailed results will be given in a later bulletin, but the coefficients obtained are given in the table below. It will be noted that the coefficients obtained for protein and fat are a little below those found by the Massachusetts Station, but are above those of soy bean silage.

DIGESTIBILITY OF SOY BEAN AND CORN FORAGE AND SILAGE.

Kind of Forage.	Kind of animal.	Number of trials.	Organic matter.	Ash.	Protein.	Crude fiber.	Nitrogen-free extract.	Ether extract.
Soy bean fodder[1]	Sheep..	8	64.5	18.9	75.1	47.0	73.2	54.0
Corn fodder[5]	Sheep..	12	72.8	44.5	66.4	75.4	72.9	69.5
Soy bean meal and timothy hay[1]	Sheep..	8	69.1	47.1	77.7	61.3	66.2	73.6
Soy bean meal alone[1]	Sheep..	8	78.0	21.3	85.8	.....	73.4	84.9
Soy bean (seed)[2]	Sheep..	2	85.0	.....	87.0	.....	62.0	94.0
Soy bean pods[2]	Sheep..	2	63.0	.....	44.0	51.0	73.0	57.0
Soy bean straw[2]	Sheep..	4	55.0	.....	50.0	38.0	66.0	60.0
Soy bean hay[2]	Sheep..	6	.....	.....	70.0	56.0	67.0	30.0
Soy bean silage[3]	Goats...	2	.....	.....	76.0	55.0	52.0	72.0
Soy bean silage[3]	Steers[4].	2	.....	.....	55.0	43.0	61.0	49.0
Corn and soy bean silage	Sheep..	3	.....	.....	65.0	65.0	75.0	82.0
Corn and soy bean silage	Sheep..	2	73.2	42.7	62.6	65.1	79.1	67.7
Corn and soy bean silage	Steers..	2	72.2	31.3	56.4	61.7	80.5	66.7
Corn silage[7]	Sheep..	7	77.0	32.5	65.4	77.4	78.5	82.9
Corn silage[6]	Sheep..	10	73.6	30.3	56.0	70.0	76.1	82.4
Barn yard millet and soy bean silage	Sheep..	4	.....	.....	57.0	69.0	59.0	72.0

[1] Ninth An. Rep. Storrs Exp. Sta., pp. 248, 250 (1896).

[2] Sixth An. Rep. Storrs Exp. Sta., pp. 160, 161 (1893), taken from European tables by Drs. Dietrich and König.

[3] Ninth An. Rep. Mass. Hatch Exp. Sta., p. 165 (1897).

[4] Very low; probably quite mature when harvested.

[5] Maine flint corn, ears glazed.

[6] Maine station unpublished results.

[7] Maine flint corn, ears glazed.

[8] Immature corn.

YIELD OF DRY MATTER AND PROTEIN.

SOY BEAN VS. CORN FODDER.

The average yield for 7 seasons at the Maine Station of fodder from corn of Sanford or similar variety that will not mature in this climate was a little over 17 tons per acre. For the same period the average yield of green fodder from matured corn was a little over 11 tons per acre. The same season that the Massachusetts Station obtained a yield of 16 tons of Longfellow corn they harvested 10 tons of soy bean fodder from one acre. If we assume an average yield of soy bean fodder at 8 tons and corn fodder at 12 tons per acre, and use in calculation the average of the 13 analyses of each material given in the table, the soy bean would yield 3,560 pounds of dry matter and the corn 5,064 pounds. The soy bean would contain 576 pounds of protein and the corn 552 pounds.

It would therefore appear that a crop of corn will give practically as many pounds of protein as a crop of soy bean, and over 40 per cent more dry matter. Furthermore, the nutrients of the corn are more digestible than those of soy beans. The corn is probably a surer crop, but on the other hand it requires a fertilizer carrying more nitrogen (costing from $10 to $15 per acre) to grow the corn and it is necessary to handle 50 per cent more material to obtain the same weight of protein.

SUMMARY.

Soy beans can be grown in parts of Maine where corn thrives.

Where early corn matures, the early white soy bean will usually mature.

Where Sanford corn ears, the early medium soy bean will form pods.

Soy bean can be grown with less nitrogen than corn.

In order to grow the soy bean most economically, the soil should be inoculated with the organism that forms root tubercles.

The soil should be prepared as for corn or beans and should be free from lumps and clods.

Fertilizers carrying phosphoric acid and potash are essential and on good land no nitrogen is needed if the soil is inoculated for root tubercles.

Sown in drills 16 inches apart, about 3 pecks of seed is needed per acre. If drilled with a grain drill or sown broadcast more seed, perhaps a bushel per acre, will be needed.

Soy beans can be grown with corn, mixing the seed at the rate of 10 quarts of corn and 7 of soy beans. Thus seeded the drills should be about 3 feet apart.

When sown in drills they should be cultivated the same as common beans. In case of narrow spaces between drills, a hand wheel hoe does the work rapidly and well.

The crop is best adapted for feeding green or for silage.

The crop can be harvested by hand or machine. For silage a grain reaper and binder leaves it convenient for handling and for the silage cutter.

A yield of 8 tons of green crop is an average in average seasons on average soil.

Eight tons of soy bean fodder carries about the same amount of protein as 12 tons corn in milk ready for the silo, but it carries only a little more dry matter than 8 tons of corn.

If grown with corn, it can be cut with the corn, by hand or a corn harvester.

When grown by itself for silage, it is best mixed with corn at time of cutting into the silo. About 3 parts corn to 2 parts beans is a very good proportion.

Less protein (the most expensive part of commercial feeding stuffs) need be fed with soy bean and corn silage than with corn silage alone.

According to Farmers' Bulletin 58, "the soy bean is excellent for green manuring and for short rotations with cereal crops. It should be well limed when plowed under as green manure."

FEEDING EXPERIMENTS WITH COWS.

CHAS. D. WOODS.

SOY BEAN SILAGE AND CORN SILAGE COMPARED.

A rough feeding experiment was made by the Station in the winter of 1903-4 in which the feeding value of the soy bean and corn silage was compared with clear corn silage. Six cows were employed and the rations fed and milk produced during each period of the experiment are given in the table below.

It will be noticed that the grain ration during the second period when the soy bean silage was fed, was reduced one pound per day for each animal. The grain mixture was very rich in protein and as the soy bean silage was richer than the corn silage, it was thought this reduction could safely be made without affecting the milk flow. The experiment was not so satisfactory as it would have been had not an epidemic of winter scours attacked the herd when the experiment was in progress. This attack was most severe during the period when the soy bean silage was being fed, consequently the yield of milk from some of the cows was much reduced. From this cause the milk flow of Gertrude was greatly reduced during the second period and her records are not included in the totals in the table.

The details of the experiment follow:

NAME OF COWS AND RATIONS FED FOR THREE PERIODS OF THREE WEEKS EACH.

First period when corn silage was fed.

Name of cows.	Rations.
Ruthele, Addie 4th, Addie 3d	Corn silage 30 lbs. per day per cow. Hay 15 lbs. per day per cow. Grain mixture 8 lbs. per day per cow.
Cummings, Ruth, Gertrude	Corn silage 30 lbs. per day per cow. Hay 15 lbs. per day per cow. Grain mixture 10 lbs. per day per cow.

Second period when soy-bean silage was fed.

Ruthele, Addie 4th, Addie 3d	Soy bean and corn silage 30 lbs. per day per cow. Hay 15 lbs. per day per cow. Grain mixture 7 lbs. per day per cow.
Cummings, Ruth, Gertrude	Soy bean silage 30 lbs. per day per cow. Hay 15 lbs. per day per cow. Grain mixture 9 lbs. per day per cow.

Third period same as first.

YIELD OF MILK PER WEEK FOR EACH COW FOR EACH PERIOD.

Feeding Periods.	Week.	Ruth —pounds.	Gertrude* —pounds.	Ruthele —pounds.	Addie 4th —pounds.	Addie 3d —pounds.	Cummings —pounds.	Total* —pounds.
First period of three weeks with corn silage.	First....	212.2	148.9	158.9	116.8	171.2	140.5	
	Second .	198.9	140.5	155.6	121.2	170.1	129.0	
	Third ...	192.6	126.5	154.2	116.6	162.0	133.6	
		603.7	415.9	468.7	358.6	503.3	413.1	2347.4
Second period of three weeks with soy bean and corn silage.	First....	174.4	115.6	147.5	113.7	155.5	133.8	
	Second .	173.3	113.1	150.8	120.5	150.5	131.8	
	Third ...	169.2	113.3	146.0	101.1	146.9	132.6	
		516.9	342.0	444.3	335.3	452.9	398.2	2147.6
Third period of three weeks with corn silage.	First....	174.4	129.2	148.7	110.7	136.6	133.9	
	Second .	169.2	147.6	146.5	104.8	156.8	135.4	
	Third ...	159.9	158.8	110.1	88.2	143.3	119.2	
		503.5	435.6	405.3	303.7	456.7	388.5	2057.7
Average of periods when corn silage was fed, milk	.....	553.6	425.6	437.0	331.2	480.0	400.8	2202.6
Soy bean and corn silage period, milk	.....	516.9	342.0	444.3	335.3	452.9	398.2	2147.6
Milk solids	.....	68.7	46.9	60.6	45.8	61.8	50.7	287.6
Butter fat	.....	23.8	16.6	20.4	16.3	22.4	18.3	101.2
Third period when corn silage was fed, milk	.....	503.5	435.6	405.3	303.7	456.7	388.5	2057.7
Solids	.....	70.2	56.5	59.2	38.9	63.9	53.6	285.8
Butter fat	.....	25.2	22.5	20.7	12.7	22.4	19.4	100.4

* Gertrude omitted from totals.

SUMMARY OF RESULTS IN THE FEEDING EXPERIMENT WHERE MIXED SOY BEAN AND CORN SILAGE WAS COMPARED WITH CORN SILAGE.

Yields per period of 3 weeks.	Average of corn silage periods.	Third period corn silage.	Soy bean period.
	Pounds.	Pounds.	Pounds.
Milk	2203	2058	2148
Milk solids	.....	286	288
Butter fat	.....	100	101

While the results are not as satisfactory as could be wished, they seem to indicate that on the whole the cows did practically as well on the mixed corn and soy bean silage with one pound less grain as on corn silage with the larger weight of grain.

UNION GRAINS AND OIL MEAL AND BRAN COMPARED.

Union Grains,—Biles Ready Ration, were introduced into the Maine market the past winter by the state agents, Norton-Chapman Company of Portland. Five samples were examined by the Experiment Station in the winter of 1904. The results were given in Bulletin 102* as follows:

"Union grains are a ready made mixture carrying protein and fat according to the guarantee. They are based upon a feeding experiment with Holstein cattle in which Biles Fourex was fed in combination with wheat bran, gluten feed, ground corn, ground oats, and oil meal. For the farmer who must buy all his feed, Union grains at a fair price would probably prove profitable. As a rule, oats and corn are profitable for cows when the feeds are home grown and are expensive feeds to purchase."

RESULTS OF ANALYSES OF UNION GRAINS.*

Name of Feed and Manufacturer or Shipper.	Protein.		Fat.		Station number.
	Found—per cent.	Guaranteed—per cent.	Found—per cent.	Guaranteed—per cent.	
Union Grains—Biles Ready Ration ..... J. W. Biles Co., Cincinnati.....	24.19	24.00	7.13	7.00	10058
	23.63	24.00	-	7.00	10245
	24.38	24.00	-	7.00	10346
	25.14	24.00	-	7.00	10561
	24.50	24.00	-	7.00	10574

* Bulletin 102, Maine Agr. Expt. Sta. on Feeding Stuff Inspection.

THE FEEDING TEST.

From a car shipped to Old Town one ton was sent to the Station, and was used in a feeding trial with milch cows. This lot carried 24.19 per cent protein and 7.13 per cent fat. When the Union Grains were received the Station herd was being fed corn silage, mixed hay containing considerable clover, and a

grain mixture, composed of 200 pounds wheat bran, 100 pounds cotton seed meal, and 100 pounds linseed meal. This grain mixture carried somewhat more protein and a little less fat than the Union Grains in comparison with which it was fed. During all the periods the weights of silage hay and grain fed each animal remained constant. The cows doing the maximum work received 8 pounds per day of grain; the others were fed less.

From the herd there were selected 18 animals, 5 Holsteins, 6 Jerseys, 2 Guernseys, 1 Ayrshire and 4 grades. They were from 3 to 6 months in milk and were all, according to their records, doing a moderate amount of work and were fairly uniform in their milk flow from day to day.

These 18 animals were gradually changed from the oil meal mixture to the Union Grains and after 2 weeks were gradually changed back to the oil meal ration. The average yields of milk on the oil meal ration for 7 days prior to the change to Union Grains and 7 days yields after the return to the oil meal rations are compared in the table with 7 days in which the Union Grains were fed.

The table on page 126 shows the milk yield of 18 cows for 2 periods of 7 days on oil meal ration, and one period of 7 days on Union Grains. The hay and silage fed was the same in all periods. The same weight of grain mixture was fed in all the periods.

The individual cows were not tested for butter fat, but the herd milk was tested in each period and ran from 4.1 to 4.3 per cent of butter fat during the test, showing that it was uniform in quality. With the exception of the cow Fan all of the cows gave more milk in the second period on Union Grain than in the average of the first and third periods on oil meal.

The test was not as satisfactory as desirable because of disturbing factors in change of milkers. But these changes did not work in favor of the Union Grains, so that there is no reason to doubt the tendency of the results and so far as this one experiment goes the Union Grains showed themselves a better food for milk production than the oil meal ration. The Union Grains cost somewhat more, however, than the mixture of oil meal and bran.

YIELD OF MILK PER WEEK FOR EACH COW FOR EACH PERIOD.

	Kind of Grain Mixture and Yield of Milk.			
	Oil Meal and Bran.			Union Grains.
	First period—seven days.	Third period—seven days.	Average first and third—seven days.	Second period—seven days.
	Pounds.	Pounds.	Pounds.	Pounds.
Guernsey	141.4	106.6	124.0	117.2
Dorothy, Ayrshire	156.5	150.5	153.0	161.5
Hunton 2d, Holstein	90.3	70.5	80.4	92.6
Hunton, Holstein	134.5	122.3	128.4	142.0
Abbie B., Holstein	120.6	109.9	115.3	119.7
Roxy, Holstein	180.5	174.5	177.5	189.5
Fan, Holstein	143.1	141.7	142.4	129.3
Bessie, Grade	115.8	98.0	106.9	119.1
Ethel, Jersey	118.6	114.1	116.3	119.2
Shaw, Grade	113.7	102.4	108.1	112.5
Celia, Grade	150.1	107.8	128.9	148.3
Judy, Jersey	97.8	84.9	91.4	106.4
Posey, Grade	140.3	112.8	126.5	120.6
Adle S., Jersey	97.0	86.3	91.7	97.0
Pansy, Jersey	83.7	59.8	71.7	81.0
Lily, Guernsey	69.5	55.0	62.8	65.4
Tulip, Jersey	72.9	55.2	64.0	74.0
Maud, Jersey	91.4	68.2	79.8	85.5
Total milk	2,117.7	1,820.5	1,969.1	2,080.9

ALFALFA.

CHAS. D. WOODS.

During the past 25 years many attempts have been made to grow alfalfa in New England. These attempts have, however, met with only partial success, and there is probably, in all New England, not a square rod of alfalfa with a good stand that has been established 5 years. Indeed, it is doubtful if, unless in the most sheltered situation, a single plant could be found that is five years old. The nearest approach to success that has come to the writer's knowledge was that of a farmer at Amesbury, Mass., and it is a significant fact that he has no alfalfa growing at the present time.

While the writer was connected with the Storrs (Conn.) Station a number of attempts to grow alfalfa were made, both on the station land and in co-operation with farmers in different parts of the state. While a few isolated plants near the shore of Long Island Sound persisted for several years, practically all died the first, or, at the latest, the second winter.

Alfalfa has been tried many times in this State, but without much promise of success. Several farmers sowed alfalfa in the spring of 1903, and in a few instances a fair percentage of the stand survived the winter of 1903-4. A small patch in a garden at Houlton, sown in the spring of 1902, probably contains as old plants as any in the State. Two cuttings were made from this in 1902, four in 1903, and three the present season. It grew luxuriantly, and most of the plants survived the first winter, but nearly two-thirds died in the winter of 1903-4. There are also in Fort Fairfield a few plants still standing on the edge of a driveway, where they were sown in 1902.

Because alfalfa has been successfully grown where formerly it was thought impracticable and because of a large number of inquiries, it was deemed best for the Station to give it another trial under the most favorable conditions of soil and treatment possible. About 4 acres are now being grown in co-operation with farmers in Orono, Penobscot county; in Princeton, Washington county; and in Houlton, Maple Grove and Fort Fairfield

in Aroostook county. The seed used was specially procured by the United States Department of Agriculture from the cold mountainous regions of Turkestan and had been inoculated with alfalfa bacteria. Root tubercles have developed abundantly on all the plots. Care was taken to select land that seemed to be naturally well adapted to alfalfa as to soil, subsoil and drainage. It was thoroughly prepared and a good stand and growth was for the most part obtained. The sowing was light (15 pounds of seed to the acre) so as to grow seed for further work if the plants should survive the first winter. All the land was well fertilized, part of it was limed and part treated with ashes. Part of the seed was broadcasted and part sown in drills. That in drills was kept free from weeds by hand wheel hoe and hand work. The broadcast portions were cut whenever the weeds seemed to endanger the alfalfa. The drilled has grown much better than the broadcast and at the cutting in August, the drilled gave on all the plots nearly a ton of rather undercured alfalfa hay.

In order to be of much value to Maine agriculture, alfalfa must be able to stand not one, but several winters. The Station does not advise anyone to grow alfalfa at present in Maine, unless in a small experimental way. Next spring the Station hopes to have a limited amount of Montana grown seed, from the United States Department of Agriculture at Washington. This will probably prove as hardy as the Turkestan seed. So far as the amount received will allow, the Station will supply enough seed for an eighth of an acre on condition that the cultural instructions will be followed and the results reported to the Station.

FREE ANALYSIS OF FEEDING STUFFS.

The Station officers take pains to obtain for analysis samples of all feeding stuffs coming under the law, but the co-operation of consumers is essential for the full and timely protection of their interests. Whenever anyone believes that this law is being evaded in any way, he is requested to notify the Director of the Station.

The Station will promptly analyze samples of feeding stuffs sold in Maine taken in accordance with the following directions and report the results without any charge to the interested parties. Dealers and consumers are urged to avail themselves of this offer.

DIRECTIONS FOR SAMPLING.

The sample should fairly represent the feeding stuff, and is best obtained as follows:

Open one or more full and unbroken packages, and mix well together the contents of each for a foot in depth, take out three cupfuls from different parts of the mixed portions of each package, pour them one over another upon a paper, intermix thoroughly and fill a tin spice or baking powder box from the mixture. Upon paper plainly write (1) the name of the goods; (2) the name of the manufacturer; (3) the guaranteed percentages of protein and fat; (4) the name and address of the dealer; and (5) the name and address of the sender. Securely wrap the box and description of sample in paper and send by mail to the

Agricultural Experiment Station,
Orono, Maine.